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METHOD AND APPARATUS TO INCREASE FUNCTIONALITY OF A USER INPUT DEVICE

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Inventor(s): SCHNEIDER DAVID T; BANKER ROBERT O; JERDING DEAN F; RODRIGUEZ ARTURO A
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Abstract

A method (200) of allowing additional functionality in user input devices (50), such as keys (18) or buttons, based on the duration of the input by the user, the duration being measured in time, number of repetitions of normal activity, or other basis. Remote controls and other user input devices have maximized functionality of buttons or keys, while allowing the number of the buttons or keys to be minimized.

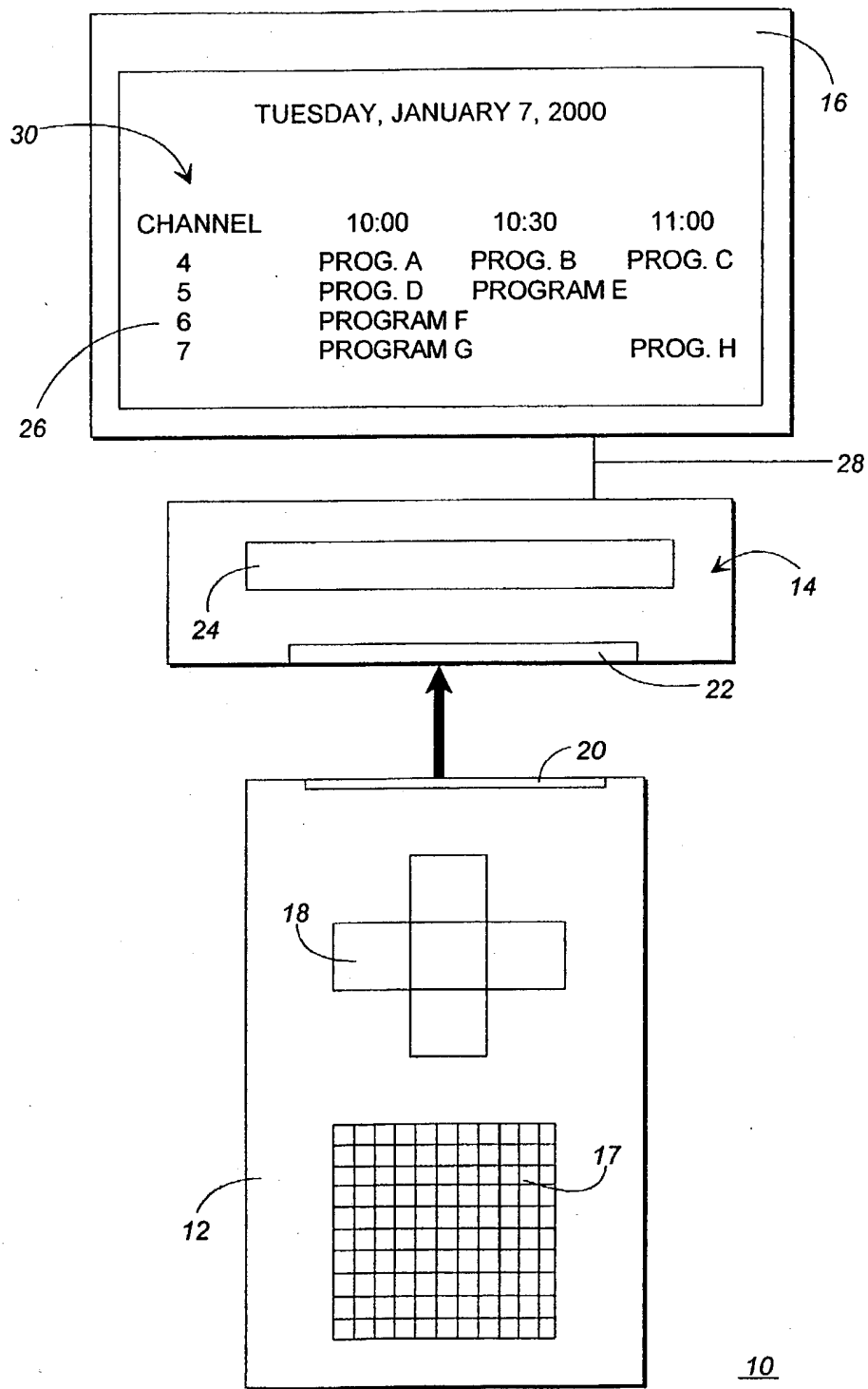
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<p>(21) International Application Number: PCT/US99/09275</p> <p>(22) International Filing Date: 29 April 1999 (29.04.99)</p> <p>(30) Priority Data: 09/071,603 1 May 1998 (01.05.98) US</p> <p>(71) Applicant: SCIENTIFIC-ATLANTA, INC. [US/US]; Intellectual Property Dept., Barnhardt, Hubert, J., III, Intellectual Property Dept., One Technology Parkway South, Norcross, GA 30092 (US).</p> <p>(72) Inventors: BANKER, Robert, O.; 1581 Chamblee Gap Road, Cumming, GA 30040 (US). JERDING, Dean, F.; 315 Seventeenth Fwy., Roswell, GA 30076 (US). RODRIGUEZ, Arturo, A.; 5315 Abigail Lane, Norcross, GA 30092 (US). SCHNEIDER, David, T.; 3980 BalleyCastle Lane, Duluth, GA 30097 (US).</p> <p>(74) Agents: BARNHARDT, Hubert, J., III et al.; Scientific-Atlanta, Inc., Intellectual Property Dept., One Technology Parkway South, Norcross, GA 30092 (US).</p>																										
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<table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="4">TUESDAY, JANUARY 7, 2000</th> </tr> <tr> <th>CHANNEL</th> <th>10:00</th> <th>10:30</th> <th>11:00</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>PROG. A</td> <td>PROG. B</td> <td>PROG. C</td> </tr> <tr> <td>5</td> <td>PROG. D</td> <td>PROGRAM E</td> <td></td> </tr> <tr> <td>6</td> <td>PROGRAM F</td> <td></td> <td></td> </tr> <tr> <td>7</td> <td>PROGRAM G</td> <td></td> <td>PROG. H</td> </tr> </tbody> </table>			TUESDAY, JANUARY 7, 2000				CHANNEL	10:00	10:30	11:00	4	PROG. A	PROG. B	PROG. C	5	PROG. D	PROGRAM E		6	PROGRAM F			7	PROGRAM G		PROG. H
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6	PROGRAM F																									
7	PROGRAM G		PROG. H																							

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**FIG. 1**

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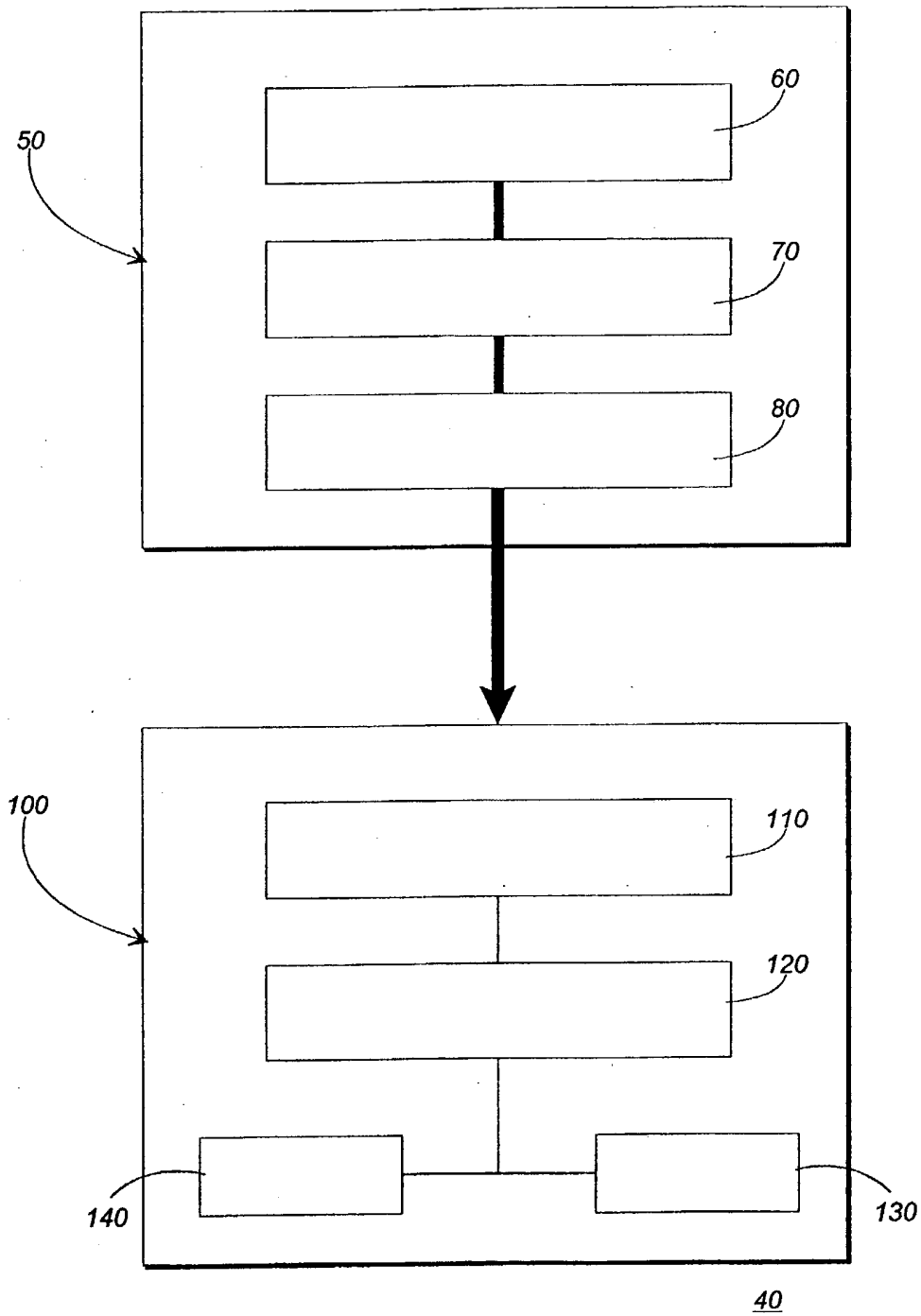
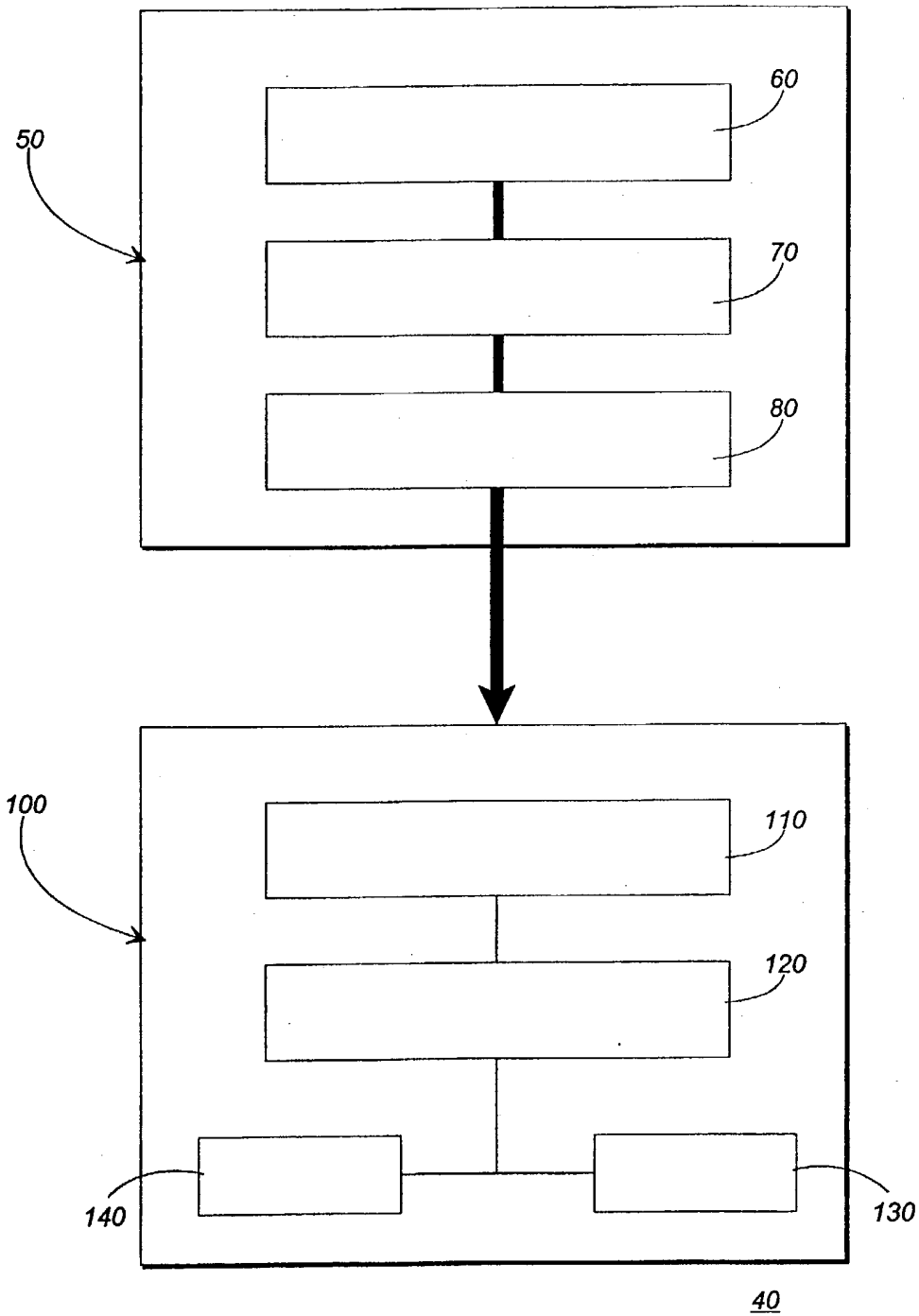
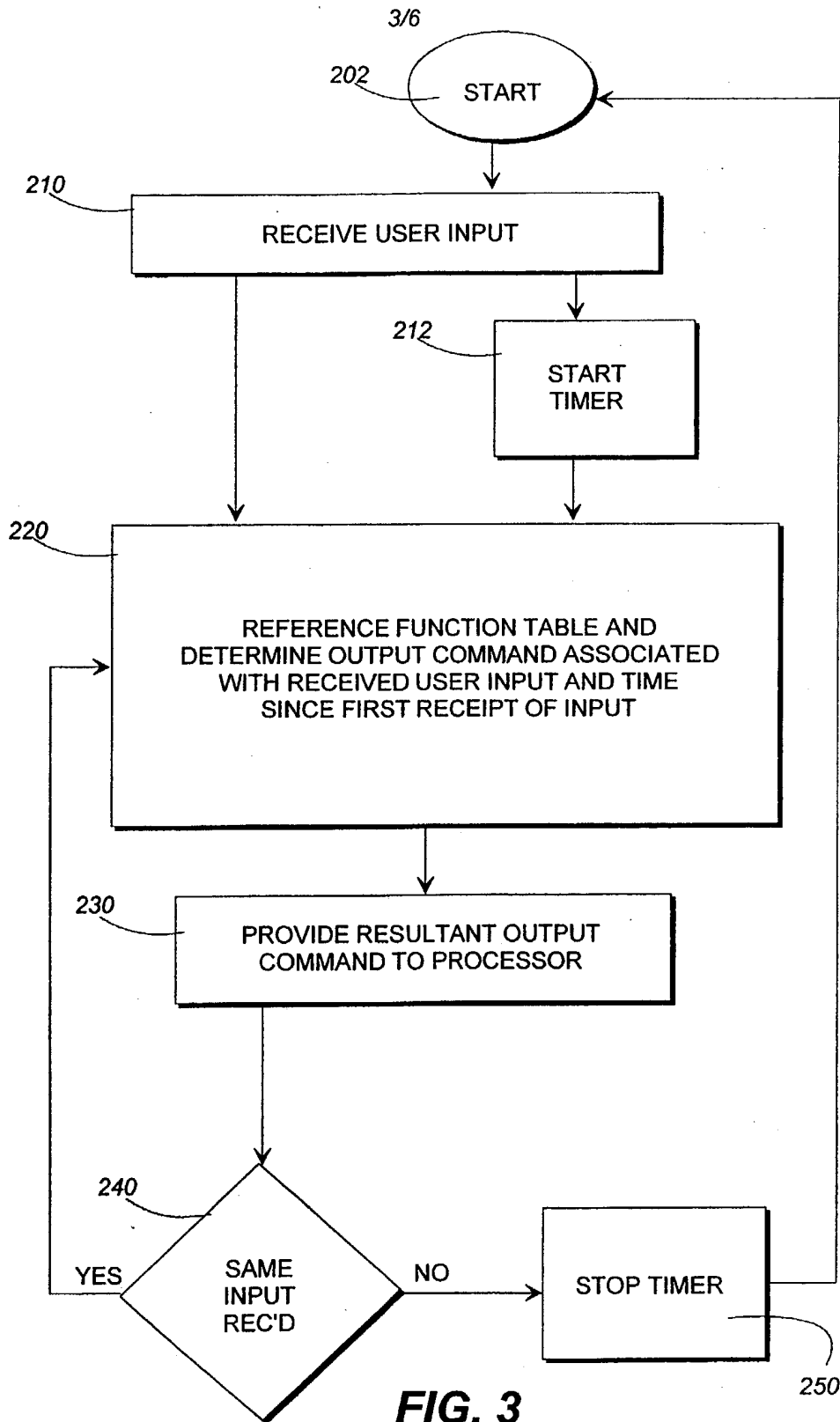


FIG. 2

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**FIG. 2**



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STEP	INPUT	TIME = N	OUTPUT
302	KEY A	$0 < N < X$	COMMAND A
304	KEY A	$X \leq N < Y$	REPEAT COMMAND A AT PREDETERMINED RATE
306	KEY A	$Y \leq N < Z$	COMMAND B
308	KEY A	$Z \leq N$	COMMAND C

WHERE $X < Y < Z$ 300**FIG. 4**

5/6

CHANNEL 4 PROGRAM GUIDE TUESDAY JANUARY 4, 2000	
9:00	PROGRAM 1
9:30	PROGRAM 1
10:00	PROGRAM 2
10:30	PROGRAM 3
11:00	PROGRAM 4

HIGHLIGHTED

FIG. 5

400

CHANNEL 4 PROGRAM GUIDE TUESDAY JANUARY 4, 2000	
10:30	PROGRAM 3
11:00	PROGRAM 4
11:30	PROGRAM 4
12:00	PROGRAM 5
12:30	PROGRAM 6

HIGHLIGHTED

FIG. 6

500

CHANNEL 4 PROGRAM GUIDE TUESDAY JANUARY 4, 2000	
10:30	PROGRAM 3
11:00	PROGRAM 7
11:30	PROGRAM 7
12:00	PROGRAM 5
12:30	PROGRAM 8

HIGHLIGHTED

FIG. 9

800

6/6

602

604

606

26

FIG. 7

CHANNEL	10:30	11:00	11:30	12:00
115	PROGRAM A		PROG. B	PROG. C
116	PROGRAM D		PROGRAM E	
117	PROGRAM F		PROGRAM G	
118	PROG. H	PROG. I	PROG. J	PROG. K
119	PROG. L	PROGRAM M		PROG. N
120	PROG. O	PROGRAM P		PROG. Q
121	PROG. R	PROGRAM S		PROG. T
122	PROG. U	PROGRAM V		PROG. W

702

704

706

FIG. 8

CHANNEL	10:30	11:00	11:30	12:00
121				
122				
123				
124				
125				
126				
127				
128				

CHANNEL 4 PROGRAM GUIDE
TUESDAY JANUARY 4, 2000

10:30

11:00

11:30

12:00

12:30

GO TO WINDOW

ENTER DESIRED
DATE AND TIME

DATE:

TIME:

750

752

754

FIG. 10

METHOD AND APPARATUS TO INCREASE FUNCTIONALITY OF A USER INPUT DEVICE

5

Technical Field

This invention relates in general to user input or interface devices, such as computers, calculators, television, Home Communications Terminals (HCT), and set tops, and in particular to a means by which users of such devices may scroll
10 through the vast amounts of information available on these devices in a more functional and efficient way.

Background

In current products, such as computers, calculators, televisions, and cable
15 television set tops also known as home communication terminals or HCTS, user input devices, such as key, key pad, or remote control, are used to scroll through information. Examples of such information include data files or television program listings and guides presented to the user to, for example, operate the device. In the example of a television, HCT, and a remote control, each time a
20 down arrow key is pressed, information is advanced by one increment of data, whether by one row, one column, one channel, one screen, one half-hour, one hour, or one page.

In certain embodiments, if the user continues to press the down arrow key, the information is advanced in the same increments, but at an increased speed.
25 The functionality of scrolling in set increments, either by a single increment at a time or by the same increments more quickly, unnecessarily restricts the user that wants to view several days of a television program guide or several columns or rows of data. It has been assumed that simply increasing the speed of the scrolling, with pauses for user scanning, would solve this problem.
30 Unfortunately, as televisions become equipped to handle over 2,000 channels, simply scrolling through information at an increased speed will not suffice. Direct channel entry has been used in the past to quickly get to channels in situations in which scrolling takes too long. This approach, however, will not work well in a 2,000 channel plus environment, since a user must remember up
35 to four digits of a selected channel number. This problem is further heightened by the fact that viewing guides may contain information for over a month of programming.

In cases where it was obvious that simply increasing the speed would not resolve the user desired functionality issue, such as scanning multiple sets of data, other solutions are currently being used. Scrolling multiple sets of data, like multiple rows, pages, or days, in a single operation requires the inefficient
5 process of using either a separate key, such as a page down key, or multiple key sets, such as pressing a shift key while pressing the down arrow key.

The solution of including additional "function" keys to perform different tasks, has a negative impact in both size and simplicity. As user input devices continue to be reduced in size, the space required for additional keys has a
10 negative economic cost. In areas where size is a concern for example, when a "function" key is pressed prior to pressing a down arrow key, the additional functionality for the down arrow key is performed for the next immediate pressing of the down arrow key. In addition this is an inefficient user process requiring the pressing of additional keys. This requires only one additional key
15 on the keypad, but as space is at a premium cost versus size, even one additional key could require a larger keypad, display screen, or remote control. In applications where size is not a restriction, simplicity of information/types of input often is, as too many keys or buttons confuse users.

An additional solution to provide additional functionality for a key, is the
20 "soft key" approach. The function of one or several keys is determined by a pre-selected mode of operation. A function display versus key location combination is required. In Mode 1, Key A is a page down key and Key B is a page up key. In Mode 2, Key A is a display time key and Key B is a set time key. Many applications, such as a remote control/television combination, do not have the
25 space required for the display or an easy way to combine the function display information with the key location, on the keypad. Further, modal user interfaces are inherently confusing to users.

An additional concern in user interfaces ("UIs") that incorporate scrolling of informational displays is the ability to meet acceptable user response times
30 regardless of the constrained environment in which the UI executes. The advent of faster processors and cheaper memory has led to graphical user interfaces annotated with complex images and animation effects. The benefits of using animation to help users perceive changes in graphical views rather than having to think about them has been pointed out by information visualization research
35 over the last ten years. However, on resource constrained platforms such as HCTs, the challenge is to present visually pleasing graphics and animation while still allowing the user to navigate quickly to items of interest. The speed of

incremental graphical UI changes in a low-cost computing display device with compute, memory and bus bandwidth constraints, such as a HCT, is limited.

Present embodiments of displays described previously often incorporate two-stage scrolling where navigational speed is first slow then faster. However, in some user interfaces, large sets or multiple fields of associated data are being displayed. These sets often comprise a key field, such as channel number, and several secondary fields, such as program information. While data for the key field may be accessed and updated rapidly since a small amount of information on the screen is being changed, the information for associated fields is usually more voluminous and must be retrieved from databases. This makes it difficult for the "fast" navigational mode to be fast enough to be acceptable to the user while scanning information from large databases. This problem is augmented as the displayable area of the TV or display device becomes larger in physical dimension requiring higher spatial resolution and as the picture rate increases as in forthcoming high-definition TV. An example would be the multitude of information, including times and program names, that is displayed when scrolling through a channel line-up on a television program guide. Accessing the database of program guide information during navigation of program displays on an HCT often does not meet the necessary user response time, especially with the increasing amount of programming on digital systems and as more detailed information such as program descriptions are displayed in addition to titles.

The task the user is trying to accomplish plays an important role in dictating how the user-interface should support navigation. In the example of a television program guide, if the user wants to go directly to a particular time or channel then a direct approach of entering the time or channel numerically is a good choice. However, this prevents the number keys from being used for other functionality and may require a mode to dictate what the number keys do when. Even with the direct approach, there are still many instances where users want to navigate in an incremental manner. For example, after jumping 24 hours into the future by pressing a Next Day button there are still 48 half-hour blocks to scroll through in a single day. Being able to do this quickly then becomes a necessity. If the user's task is simply browsing to see what is on different channels or times, the direct approach does not allow the users to see information for the channels they are skipping. Browsing tasks call for scrolling or paging such that the user has an opportunity to catch a glimpse of something of interest.

Accordingly, there exists a need to provide a user input device with enhanced functionality, but free from the difficulties inherent in current devices. Such a device should address the need to scroll multiple sets of data, without

having to depress multiple inputs. Moreover, such a device should be easy to use, presenting information to a user in an intuitive fashion

5 **Brief Description of the Drawings**

FIG. 1 is a block diagram of a system for outputting commands based on received user input commands in accordance with the invention;

FIG. 2 is a block diagram of a system for outputting commands to a display or data port;

10 FIG. 3 is a flow diagram illustrating the determination of the output command to be performed;

FIG. 4 is a simple function table, which would be stored in data storage or memory, used for determining the output corresponding to a user input;

15 FIG. 5 is an example of a display of information which can be scanned by a user, with first piece of information highlighted;

FIG. 6 is an example of the highlight continuing to advance in predetermined half hour increments in response to user input; and,

FIG. 7 is an example in which a first display of information includes main fields of displayed information, and associated fields of displayed information;

20 FIG. 8 is an example of a display of information as in FIG. 7, in which the associated fields are "grayed" or dimmed while scrolling at an accelerated rate;

FIG. 9 is an example of a different output command being used in response to continuous user input; and

25 FIG. 10 illustrates an example of a user navigable table which may result from selection of a particular user input.

Detailed Description of the Preferred Embodiment

30 While the specification concludes with claims defining the features of the invention that are regarded as novel, it is believed that the invention will be better understood from a consideration of the following description in conjunction with the drawing figures, in which like reference numerals are carried forward.

Referring now to FIG. 1, there is illustrated therein a block diagram of a system 10 for outputting commands based on received user input commands.
35 The system 10 includes a control device 12, such as a remote control; a information processing device 14 such as a cable or satellite television Home Communications Terminal (HCT); and a display 16, such as a television. To effect a command or instruction, a user (not shown) presses a key on a keypad 17, such

as down arrow key 18 on remote control 12. A transmitter 20 located in remote control 12 transmits the user input to a receiver 22 in HCT 14. Receiver 22 communicates the user input information to a processing module 24, which determines the correct output based on the user input and the duration of the user input, as explained in greater detail below. The transmitter 20 and receiver 22 are conventional devices which communicate in a manner well known in the art, examples of which are hard wired, infra-red, and radio frequency communication to name a few. Likewise, HCT 14 and television 16 are coupled in a manner known in the art, such as via cable 28.

The displayed output 30 shown on screen 26 may be, for example, television programming information sorted by one or more relevant criteria. The resultant output command is displayed on the screen 26 of the television 16. Alternatively in a computing environment, the remote control 12 may be a keyboard coupled to an information processing device 14 such as a computer, which is in turn coupled to a display monitor 16. In this example, the displayed output 30 may combine computer generated information such as pages of a spreadsheet, pages of text or an accumulated database to name a few.

FIG. 2 is a block diagram of a system 40 for outputting commands to a display 140 or data port 130. The resultant output commands can be, but are not limited to functionality such as, instructions, such as display next line of data, or action, such as continue scrolling down displayed information at an accelerated number of lines per second. The output commands are based on received user input commands. The input 60 can be produced from a wide variety of inputs, including but not limited to: actuating a key or a button as by depressing it, clicking an active area on a tool or a scroll bar, or moving a cursor to an area on a display screen.

Time since first receipt, with the continued receipt, of user input herein is used to measure duration and to illustrate the operation of the system, however it is to be noted that the invention is not so limited. The duration could be dependent on other variables such as the repetition of a predetermined number of normal operations.

Control device 50, for example a remote control such as remote control 12 of FIG. 1, receives an input from a user. The user actuates a key, input 60, providing a user input. The user input 60 is communicated to a processor 70 or to transmitting device 80. The control device 50 further includes a processor 70 which may include timing means and a memory for storing a data table. This processor is adapted to determine the correct output command based upon the received user input, in a manner as described below with reference to Figs. 3-7. It

is to be noted that the function of the processor 70 may also or alternatively be placed in the information processing device 100, as by providing a controller 120 which likewise includes a timing means and memory storage.

The user input, either processed by processor 70 or not, is transmitted to information processing device 100 via transmitting device 80. As noted above, transmitting device 80 may be any of a number of devices known in the art, examples of which include hard wired, infra-red, and radio frequency. This transmitted information is received in information processing device 100 by a receiving device 110. The receiving device 110 must be compatible with the transmitting device 80, i.e., capable of receiving information from the type of transmitting device selected.

As noted above, the function of determining the correct output command based on the received user input is carried out in either a processor 70 located in control device 50, and/or a controller 120 in information processing device 100. If the input is to be processed in the information processing device 100, the signal received by the receiving device 110 is passed to the processor 120 which is electronically coupled thereto, for processing as described below. The processed input, i.e., the output command may then be passed to, for example, output devices such as data port 130 or display 140.

Referring now to FIG. 3 there is illustrated a flow diagram 200 for determining the output command based upon a received user input. At start 202, the operation waits for a user input. Upon receiving user input the received user input 210 starts a timer 212 and references a function table stored in, for example processor 70, to determine an output command associated with the received user input and the time since first receipt of input 220. Based on the user input and the duration of the input as measured by the timer, the function table provides a resultant output command to processor 230. Therefore, at step 240, the processor checks to determine if the same user input is still being received. If yes, steps 220, 230, and 240 are performed again, providing the resultant output command based on the function table. If not, the processor stops timing 250 and returns to start 202.

FIG. 4 is a simple function table 300 for a single key on a user input device. A function table is used as an example to simplify the explanation of the relationship between output command/function and duration, though the invention is not so limited, mathematical calculations, formulas, or other methods can also be used. The function table may be stored in data storage or memory and used for determining the output, corresponding to a user input and the duration of the user input. More complex function tables or calculations can

be constructed for multiple keys on a user input device, but for ease of explanation, this simple example is shown here. It is to be noted that while the invention is illustrated with a single function key and simplified function table, the invention is not so limited. Any number of function keys, the outputs of which are determined in various ways, are all contemplated herein.

Referring now to Figs. 4-10, and in particular FIG. 4, the initial input of Key A, illustrated in Step 302, results in the output of Command A, as the duration of the user input, N, is greater than zero (0) but less than a predetermined time X. The result of an output Command A could be the highlighting of a line in a display. FIG. 5 is an example of a display 400 which can be scanned or scrolled. As in Step 302, upon depressing Key A the highlight area would advance from a first row, highlighting 9:00 on Tuesday, January 4, to another row, highlighting 9:30 on Tuesday, January 4.

In FIG. 4 Step 304, predetermined time X is less than predetermined time Y. If input of Key A continues such that duration N becomes greater than predetermined time X, but is still less than predetermined time Y, the output may be, for example, the repetition of Command A at some predetermined rate, allowing a pause between repetitions so that the user can scan the resultant outcome of the repeated Command A, such as the highlighting the next line or column.

This result is illustrated in FIG. 6 wherein the highlight continues to advance in predetermined half hour increments as the user continues to press Key A such that duration N is greater than predetermined time X, as in FIG. 4 Step 304. Advancing to 10:30, then 11:00, then 11:30, and so forth, still on Tuesday, January 4, until the user stops pressing Key A or the duration N is greater than predetermined time Y. The invention also allows for the user setting and/or selecting the output command/functionality, or at least some associated parameters, for example the user could chose between different, medium, fast, faster, scrolling speeds for the predetermined rate of repetition for Command A.

FIG. 7 illustrates an application with main data of interest, field 602 and multiple fields of associated data 604, 606. As previously noted, updating the associated fields of data can either slow the speed of data display considerably, or will require considerable additional memory.

The command repetition rates referred to in the previous discussion are limited by the capabilities of the device on which the informational interface is implemented. Such performance can be limited by the processor speed or amount of memory available. This invention also provides a configurable mechanism for navigating displays of information on resource constrained

devices whereby the presentation adapts to provide optimal combinations of animation and response time depending on the user's tasks.

FIG. 8 illustrates an application with main data of interest 702 and multiple fields of secondary, or associated data 704, 706. As previously noted, updating the associated fields of data can slow the speed of navigation considerably. Accordingly, the user interface during repetition of **Commands** can be configured to 1) control the transformation of the informational display, such as animating a highlight moving from one row to another, during each repetition of the **Command**, and 2) as illustrated in FIG. 8, control whether the fields of associated data 704, 706, in whole or in part, are either updated with each command repetition or are not updated and depicted as deactivated or "grayed out". When associated fields 704, 706 of the data are not updated during the **Command** repetition, said fields are illustrated in some visual manner to the user as not active or "phantom". When the user stops the **Command** repetition that has been configured to not update the associated data, the associated data for the currently displayed key data is retrieved and displayed in normal form. The reduction of the associated data to a phantom mode could be depicted in many different ways by someone skilled in the art, including but not limited to graying out the display area, dimming the intensity of that area of the display, providing a message to the user that the fields are inactive. The "phantom" display mode is used with any functionality where the display has associated data and rapidly changing primary or key data.

The configurability of the scrolling can be applied in many combinations to the **Command** model described earlier. In one embodiment, **Command A** could be a single incremental scroll set to use full animation and full update of fields before time X and then minimal animation and full update of fields after time X and before time Y. Then **Command B** of FIG. 4 could be a single incremental scroll set to use no animation and only update the main fields and dim the associated fields. In another embodiment, **Command A** could be a single incremental scroll set to use full animation and full update of fields before time X and then no animation and only key field update (with associated fields dimmed) after time X and before time Y. Then **Command B** could be a page scroll with full animation and full update of fields, and **Command C** could be a page scroll with no animation and only update of key fields (with associated fields dimmed). Still another embodiment could provide two different phases to **Command B** and **Command C**, much like **Command A**. This would allow **Command A** to be single scrolls, **Command B** to be page scrolls, and **Command C** to be multi-page scrolls, all configurable with initial repetitions of animation and full field update

and final repetitions with no animation and only key field update with associated fields displayed in the dim mode.

In one preferred embodiment, the default configurations for the transformation of the screen during the update and the associated field update display are set from the server or controller of the system, such as the headend of a cable HCT network. The user interface also provides the user a mechanism to customize the scrolling navigation by choosing among predefined sets of configurations labeled appropriately for the user, such as "Scroll Mode: Slow, Medium, Fast". The configurable parameters for a preferred embodiment of the scrolling navigation are shown in FIG. 10, discussed in greater detail below.

Referring to FIG. 4 Step 306, predetermined time Y is less than predetermined time Z. When input of Key A continues such that duration N becomes greater than predetermined time Y, but less than time Z, the output becomes **Command B**. **Command B** can be any other available command, such as scrolling multiple increments of data, page down, page up, end of page, top of page, end, start, home, next day, next screen, next channel or display a user window or menu. **Command B** could advance a whole page down of information, a whole day forward, or multiple lines, as opposed to the advancing of a line or column at a time as in **Command A**. **Command B** would repeat at some predetermined rate the advance, pausing between repetitions so that the user can scan the resultant outcome and stop the advance by stopping the input, in this example, stop pressing Key A. FIG. 9 is an example of a different output command being used, advancing by days, as in FIG. 4 Step 306. As the duration N of pressing Key A became greater than time Y, the scanning started advancing by days rather than half hours. Now highlighting 10:30 on Friday, January 7. FIG. 10 is an example of a different output command of displaying a pop-up window, as in FIG. 4 Step 306. As the duration N of pressing Key A became greater than time Y, a pop-up window 750 is displayed allowing the user to enter the desired date 652 and time 754 to be displayed.

In FIG. 4 Step 308, if input of Key A continues such that duration N becomes greater than predetermined time Z, the output becomes **Command C**. This step is included to teach that additional functionality may be added, such as scrolling by half hour on single inputs and for a duration greater than time X, scrolling by page for a duration greater than time Y, scrolling by date for a duration greater than time Z, and so forth. Scrolling the data initially in small single increments, with a single action or repeatedly at a predetermined rate, then scrolling in multiple increments, followed by even larger data increments or other functions, such as going to the end of the data or allowing the user to enter

information using a pop-up window or user menu, all based on the duration of the user input, could be done using the invention.

While the preferred embodiments of the invention have been illustrated and described, it will be clear that the invention is not so limited. Numerous
5 modifications, changes, variations, substitutions and equivalents will occur to those skilled in the art without departing from the spirit and scope of the present invention as defined by the appended claims.